Claims

1. A process for preparing formaldehyde by gas-phase oxidation of methanol vapor by means of a gas stream comprising molecular oxygen in the presence of a fixed-bed catalyst comprising iron and molybdenum, wherein the process is carried out in a reactor (1) having heat-exchange plates (2) which are arranged in the longitudinal direction of the reactor (1) and have a spacing between them and through which a heat transfer medium flows, inlet and outlet facilities (3, 4) for the heat transfer medium to the heat-exchange plates (2) and also gaps (5) between heat-exchange plates (2) in which the fixed-bed catalyst is present and into which the methanol vapor and the gas stream comprising molecular oxygen are passed.

2. A process according to claim 1, wherein the heat-exchange plates (2) are arranged parallel to one another in the reactor (1).

3. A process according to claim 1, wherein the reactor (1) is cylindrical and the heat-exchange plates (2) are arranged radially to leave a central space (6) and a peripheral channel (8) free in the cylindrical reactor (1) and the gas stream comprising methanol vapor and molecular oxygen is preferably fed radially into the gap (5) between the heat-exchange plates (2).

4. A process according to claim 3, wherein the radial extension (r) of the heat-exchange plates (2) is from 0.1 to 0.95 of the reactor radius (R), preferably from 0.3 to 0.9 of the reactor radius (R).

5. A process according to any of claims 1 to 4, wherein the reactor (1) is made up of two or more, in particular detachable reactor sections and each reactor section is preferably equipped with a separate heat exchange medium circuit.

6. A process according to claim 1 or 2, wherein the reactor (1) is equipped with one or more cuboidal heat-exchange plate modules (9) which are each made up of two or more rectangular heat-exchange plates (2) which are arranged parallel to one another so as to leave a gap (5) between them.

7. A process according to claim 1, wherein the reactor (1) has four quarter-cylindrical cuboidal heat-exchange plate modules (9) each having identical dimensions.

8. A process according to claim 6, wherein the reactor (1) has two or more cuboidal heat-exchange plate modules (9) each having identical dimensions.

9. A process according to claim 8, wherein the reactor (1) has 4, 7, 10 or 14 heat-exchange plate modules (9).

10. A process according to any of claims 1 to 9, wherein the heat-exchange plates (2) are each made up of two rectangular metal sheets which are joined on their longitudinal sides and ends by rolled seam welding and the margin of the metal sheets projecting beyond the rolled seam is separated off at the outer edge of the rolled seam or in the rolled seam itself.

11. A process according to any of claims 6 or 8 to 10, wherein the reactor (1) is cylindrical and an inert gas is fed into the space between the heat-exchange plate modules (9) and the cylindrical wall of the reactor (1).

12. A process according to any of claims 1 to 11, wherein the fixed-bed catalyst in the gaps (5) is arranged in zones having a differing catalytic activity, in particular by providing, in the flow direction of the reaction gas mixture, firstly an inert bed, subsequently a catalytically active zone and finally preferably a further inert bed.

13. A process according to claim 12, wherein the fixed-bed catalyst has a catalytic activity which changes in the flow direction of the reaction gas mixture in the region of the catalytically active zone, preferably so that the catalytic activity increases in the flow direction of the reaction gas mixture.

14. A process according to any of claims 1 to 15, wherein a fixed-bed catalyst made up of particles having an equivalent particle diameter (d_p) in the range from 2 to 6 mm is used.

15. A process according to any of claims 1, 2 or 6 to 14, wherein the width (s)

of the gap (5) is in the range from 8 to 50 mm, preferably in the range from 13 to 20 mm, in particular 14 mm, and the ratio of the width of the gap (5) to the equivalent particle diameters (s/d_p) is from 2 to 10, preferably from 3 to 8, particularly preferably from 3 to 5.

16. A process according to any of claims 1 to 15, wherein the superficial velocity of the reaction gas mixture in the gaps (5) is up to 4.5 m/s, preferably in the range from 1.0 to 2.5 m/s, particularly preferably about 2 m/s.

17. A process according to any of claims 1 to 16, wherein the reaction gas mixture is taken from the reactor (1), introduced directly into an after-cooler (10) which is preferably equipped with heat-exchange plates through which a cooling medium flows, with the reaction gas mixture preferably being cooled to a temperature below 150°C, preferably to a temperature below 110°C, in the after-cooler (10).

18. A process according to any of claims 1 to 17, wherein the reaction gas mixture and the heat transfer medium are conveyed in cocurrent through the reactor (1).